MATH 151, SPRING 2011
COMMON EXAM II - VERSION B

LAST NAME, First name (print): ____

INSTRUCTOR: ___________________________

SECTION NUMBER: _____________

UIN: ____

SEAT NUMBER: ___________________________

DIRECTIONS:

1. The use of a calculator, laptop, or computer is prohibited.
2. In Part 1 (Problems 1-12), mark the correct choice on your ScanTron using a No. 2 pencil. *For your own records, also record your choices on your exam!*
3. In Part 2 (Problems 13-17), present your solutions in the space provided. *Show all your work* neatly and concisely and *clearly indicate your final answer*. You will be graded not merely on the final answer, but also on the quality and correctness of the work leading up to it.
4. Be sure to *write your name, section and version letter of the exam on the ScanTron form.*

THE AGGIE CODE OF HONOR
"An Aggie does not lie, cheat, or steal, or tolerate those who do."

Signature: ____

DO NOT WRITE BELOW!

Question	Points Awarded	Points
1-12		48
13		9
14		15
15		8
16		8
17		12
TOTAL		100

1. A particle moves according to the position function $s(t) = 2t^3 - 21t^2 + 72t - 53$ (s is in inches, t is in seconds). What is the velocity after 1 second?

   (a) -30 in/sec
   (b) -17 in/sec
   (c) -11 in/sec
   (d) 0 in/sec
   (e) 36 in/sec

2. Compute $\lim_{x \to 0} \frac{1 - \cos x}{2x}$.

   (a) $\frac{1}{2}$
   (b) $\frac{\pi}{4}$
   (c) 1
   (d) 0
   (e) $-\frac{1}{2}$

3. Let $f(x) = x^3 + x$. If $g = f^{-1}$, find $g'(2)$.

   (a) $\frac{1}{4}$
   (b) 14
   (c) 4
   (d) $-\frac{13}{100}$
   (e) $\frac{1}{14}$

4. Find the inverse function of $f(x) = \sqrt{x-5}$ and state its domain.

(a) $f^{-1}(x) = (x+5)^2$, $(-\infty, \infty)$
(b) $f^{-1}(x) = x^2 + 5$, $[0, \infty)$
(c) $f^{-1}(x) = x^2 + 5$, $(-\infty, \infty)$
(d) $f^{-1}(x) = x^2 + 5$, $[5, \infty)$
(e) $f^{-1}(x) = (x+5)^2$, $[-5, \infty)$

5. Which of the following is an equation of the line tangent to the curve parametrized by $x = t^2 - 4t + 1$, $y = t^3$ at the point corresponding to $t = 2$?

(a) $y - 8 = -\dfrac{27}{10}(x+3)$
(b) $y - 8 = 12(x+3)$
(c) $y = 8$
(d) $x = -3$
(e) $x = 2$

6. The vector function $\mathbf{r}(t) = \langle t + e^t,\, t + t^2 \rangle$ represents the position of a particle at time t. Find the speed of the object at the point $(1, 0)$.

(a) $\sqrt{2}$
(b) 1
(c) $\sqrt{5}$
(d) $\sqrt{e^2 + 2e + 2}$
(e) $\sqrt{e^2 + 2e + 10}$

7. Which of the following is the quadratic approximation of the function $f(x) = \cos(2x)$ at $a = \frac{\pi}{2}$?

(a) $Q(x) = -1 + 4\left(x - \frac{\pi}{2}\right)^2$

(b) $Q(x) = -1 + 2\left(x - \frac{\pi}{2}\right)^2$

(c) $Q(x) = -1 + \frac{1}{2}\left(x - \frac{\pi}{2}\right)^2$

(d) $Q(x) = 1 - 2x^2$

(e) $Q(x) = 1 - 4x^2$

8. If $f(x) = \frac{4x+1}{2x+3}$, what is $f'(1)$?

(a) -10

(b) $\frac{12}{25}$

(c) $\frac{2}{5}$

(d) $-\frac{2}{5}$

(e) 2

9. Let f be a differentiable function with $f(2) = 3$ and $f'(2) = -5$. If $g(x) = x\,f(x)$, find an equation of the line tangent to g at the point where $x = 2$.

(a) $y - 3 = -5(x - 2)$

(b) $y - 6 = -7(x - 2)$

(c) $y - 6 = -10(x - 2)$

(d) $y = 3x$

(e) $y - 6 = -5(x - 2)$

10. Which of the following functions satisfy the differential equation $y'' + y' - 6y = 0$?

(a) $y = e^{3x}$
(b) $y = e^{x}$
(c) $y = e^{-2x}$
(d) $y = e^{-4x}$
(e) None of these is correct

11. Find the limit: $\lim_{x \to 2^+} 3^{1/(2-x)}$.

(a) The limit does not exist.
(b) 3
(c) 0
(d) 1
(e) ∞

12. Find the slope of the line tangent to the curve $f(x) = (x^2 + 1)^3$ at the point $(1, 8)$.

(a) 24
(b) 8
(c) 32
(d) 12
(e) 6

PART II WORK OUT

<u>Directions</u>: Present your solutions in the space provided. *Show all your work* neatly and concisely and *Box your final answer*. You will be graded not merely on the final answer, but also on the quality and correctness of the work leading up to it.

13. (9 points) A ladder 10 feet long rests against a vertical wall. If the bottom of the ladder slides away from the wall at a rate of 1 ft/s, how fast is the top of the ladder sliding down the wall when the bottom of the ladder is 6 feet from the wall?

14. (5 points each) Find the derivatives of each of the following. You do **NOT** have to simplify your final answers.

(a) $f(x) = x^2 \cot(3x)$

(b) $g(x) = \dfrac{e^{\sqrt{x}}}{\sqrt{x} + x^2}$

(c) $u(x) = \tan^3(e^{-x} - ex + e^2)$

15. (8 points) Find a tangent vector of unit length to the curve $\mathbf{r}(t) = \left(\frac{8}{3}\cos^3 t\right)\mathbf{i} + \left(\frac{8}{3}\sin^3 t\right)\mathbf{j}$ at the point where $t = \frac{\pi}{6}$.

16. (8 points) Given $f(x) = (1-x)^{-1}$, find a formula for $f^{(n)}(x)$, the nth derivative of f.

17. The strength S of a support beam is related to its thickness T by the equation $S^3 + \frac{1}{2}S = T^2$.

(a) (5 points) Find $\frac{dS}{dT}$.

(b) (2 points) Show that, when $T = 3$, $S = 2$.

(c) (5 points) Use differentials or linear approximation to estimate the strength S when the thickness is $T = 3.1$.